

IAP5 Rec'd PCT/PTO 27 JUL 2006



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The Receiving Office

24 August 2005

COPY

Sir

**IN THE MATTER OF International Patent Application No. PCT/AU2005/000099  
in the name of COMMONWEALTH SCIENTIFIC AND INDUSTRIAL  
RESEARCH ORGANISATION**

- and -

**IN THE MATTER OF Demand for International Preliminary Examination  
Our Ref: JSB:SP:FP21080**

We lodge herewith:

1. A Demand for International Preliminary Examination together with the prescribed fee of \$768.00.
2. Amended page 5 and claims pages 29 to 33.

The revised claims specify that the hydroxyoxime is an aliphatic hydroxyoxime. The prior art does not teach the claimed combination of integers, nor does it establish that there was any motivation to make this specific combination.

The claim amendments also include amendments to insert dependent claims 3 to 11 directed to specific features of the extraction stage. These features are not shown, and are not achievable, in the processes of the prior art.

Favourable reconsideration of the application is requested.

Yours faithfully  
GRIFFITH HACK

**Janelle Borham**  
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enc

MELBOURNE

SYDNEY

PERTH

BRISBANE

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ \_\_\_\_\_

# **PCT** **DEMAND**

## **CHAPTER II**

under Article 31 of the Patent Cooperation Treaty:  
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation

For international Preliminary Examining Authority use only \_\_\_\_\_

Identification of IPEA

Date of receipt of DEMAND

### **Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION**

Applicant's or agents file reference  
JSB:FP21080

International application No.  
PCT/AU2005/000099

International filing date (day/month/year)  
28 January 2005

(Earliest) Priority date (day/month/year)  
28 January 2004

Title of the invention  
SOLVENT EXTRACTION PROCESS FOR SEPARATING COBALT AND/OR NICKEL FROM  
IMPURITIES IN LEACH SOLUTIONS

### **Box No. II APPLICANT(S)**

Name and address: (Family name followed by given name; for a legal entity, full official designation.  
The address must include postal code and name of country)

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Applicant's Registration No. with the office

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State (that is, country) of nationality:  
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State (that is, country) of residence:  
AUSTRALIA

☐ Further applicants are indicated on a continuation sheet.

See Notes to the demand form

**Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**

The following person is ☒ agent ☐ common representative  
 and ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.  
☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked  
☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official designation.  
 The address must include postal code and name of country)*

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☐ Address for correspondence: Mark this checkbox where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments\***

1. The applicant wishes the international preliminary examination to start on the basis of:

☐ The international application as originally filed  
 the description ☐ as originally filed  
☐ as amended under Article 34

the claims ☐ as originally filed  
☐ as amended under Article 19 (together with any accompanying statement)  
☐ as amended under Article 34

the drawings ☐ as originally filed  
☐ as amended under Article 34

2. ☐ The applicant wishes any amendment to the claim under Article 19 to be considered reversed.

3. ☐ Where the IPEA wishes to start the international preliminary examination at the same time as the international search in accordance with Rule 69.1(b), the applicant requests the IPEA to **postpone** the start of the international preliminary examination until the expiration of the applicable time limit under Rule 69.1(d).

4. ☐ The applicant expressly wishes the international preliminary examination to start earlier than at the expiration of the applicable time limit under Rule 54bis.1(a).

\* Where no checkbox is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purpose of international preliminary examination: ENGLISH

☒ which is the language in which the international application is filed  
☐ which is the language of a translation furnished for the purposes in international search  
☐ which is the language of publication of the international application  
☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

**Box No. V ELECTION OF STATES**

The filing of this demand constitutes the election of all Contracting States which are designated and are bound by Chapter II of the PCT.

**Box no. VI CHECK LIST**

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

For International Preliminary  
Examining Authority use only

received not received

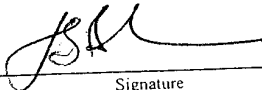
- |  |        |                          |                          |
|--|--------|--------------------------|--------------------------|
| 1. translation of international application:                             | sheets | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. amendments under Article 34:  | sheets | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. copy (or where required, translation) of amendments under Article 19: | sheets | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. copy (or where required, translation) of statement under Article 19:  | sheets | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. letter:   | sheets | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. other (specify):  | sheets | <input type="checkbox"/> | <input type="checkbox"/> |

The demand is accompanied by the item(s) marked below:

- |  |   |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet                             | 5. <input type="checkbox"/> statement explaining lack of signature                  |
| 2. <input type="checkbox"/> original separate power of attorney                          | 6. <input type="checkbox"/> sequence listing in electronic form                     |
| 3. <input type="checkbox"/> original general power of attorney                           | 7. <input type="checkbox"/> tables in electronic form related to a sequence listing |
| 4. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 8. <input type="checkbox"/> other (specify):  |

**Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE**

Next to each signature indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand)

  
Signature

24/08/2005  
Date

Janelle Borham of Griffith Hack for and behalf of the applicant(s)

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- |  |  |
|--|--|
| 1. Date of actual receipt of DEMAND:   |  |
| 2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):   |  |
| 3. <input type="checkbox"/> The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply<br><input type="checkbox"/> The applicant has been informed accordingly | 6. <input type="checkbox"/> The date of receipt of the demand is AFTER the expiration of the time limit under Rule 54bis.1(a) and item 7 or 8, below, does not apply.                        |
| 4. <input type="checkbox"/> The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of rule 80.5  | 7. <input type="checkbox"/> The date of receipt of the demand is WITHIN the time limit under Rule 54bis.1(a) as extended by virtue of Rule 80.5.   |
| 5. <input type="checkbox"/> Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.   | 8. <input type="checkbox"/> Although the date of receipt of the demand is after the expiration of the time limit under Rule 54bis.1(a), the delay in arrival is EXCUSED pursuant to Rule 82. |

For International Bureau use only

Demand received from IPEA on:

See Notes to the demand form

# PCT

## CHAPTER II

### FEE CALCULATION SHEET

Annex to the Demand for international preliminary examination

For International Preliminary Examining Authority use only

International application No. PCT/AU2005/000099		Date stamp of the IPEA	
Applicant's or Agent's file reference JSB:FP21080			
Applicant COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION			
<b>Calculation of prescribed fees</b>			
1. Preliminary examination fee .....	\$550.00	P	
2. Handling fee ( <i>Applicants from certain states are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.</i> )	\$218.00	H	
3. Total prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box	\$768.00		
		TOTAL	
<b>Mode of Payment</b>			
<input type="checkbox"/> authorisation to charge deposit account with the IPEA (see below)		<input type="checkbox"/> cash	
<input checked="" type="checkbox"/> cheque		<input type="checkbox"/> revenue stamps	
<input type="checkbox"/> postal money order		<input type="checkbox"/> coupons	
<input type="checkbox"/> bank draft		<input type="checkbox"/> other (specify):	
<b>Authorisation to Charge (or Credit) Deposit Account</b> <i>(This mode of payment may not be available at all IPEA's)</i>			
<input type="checkbox"/> Authorisation to charge the total fees indicated above		IPEA/ _____	
<input type="checkbox"/> (this check box may be marked only if the conditions for deposit accounts of the IPEA so permit) Authorisation to charge any deficiency or credit any overpayment in the total fees indicated above		Deposit Account Number _____	
		Date _____	
		Name _____	
		Signature _____	

According to one embodiment, the recovery step comprises selective stripping of the organic phase to separate the cobalt from the nickel. The cobalt may thereafter be recovered from the loaded aqueous strip liquor, and the nickel recovered from the selectively stripped organic solution by bulk stripping.

#### Brief Description of the Drawings

The invention will be described in further detail with reference to the following figures which relate to embodiments of the invention.

Figure 1 is a schematic flow chart of the steps of the process of one embodiment of the invention.

Figure 2 is a more detailed schematic flow chart of a part of the process illustrated in Figure 1.

Figure 3 is a schematic flow chart of a second embodiment of the invention, which is a variation on the process illustrated in Figure 2.

Figures 4 and 5 are graphs comparing extraction pH isotherms of metals using a comparative extraction system (Figure 4) and the extraction system containing Versatic 10 and LIX63 (Figure 5).

Figure 6 is a graph showing the stripping kinetics of metals from a loaded organic phase from the extraction system of a second embodiment of the invention.

Figure 7 is a graph showing the Extraction pH isotherms of metals from the organic phase of system of Figure 6.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A process for the separation of nickel, cobalt or both from impurity elements selected from one or more of calcium, magnesium, manganese and chloride contained in a leach solution, the process comprising the step of subjecting the leach solution to solvent extraction using a carboxylic acid, an aliphatic hydroxyoxime and a kinetic accelerator.
2. The process of claim 1, wherein the solvent extraction step comprises contacting the leach solution with an organic solution comprising the carboxylic acid, hydroxyoxime and kinetic accelerator.
3. The process of claim 2, wherein cobalt poisoning as a result of oxidation of cobalt(II) to cobalt(III) is avoided.
4. The process of claim 2 or claim 3, wherein all of an organic phase separated from the solvent extraction step is subjected to stripping with an acid solution to strip metals present from the organic phase.
5. The process of claim 4, wherein the stripping step is preceded by a scrubbing step.
6. The process of claim 4 or claim 5, wherein the stripping step is a selective stripping step.
7. The process of any one of claims 2 to 6, wherein the organic solution displays fast extraction kinetics for nickel, cobalt, copper, zinc and manganese.
8. The process of any one of claims 2 to 7, wherein the organic solution is in contact with the leach solution for a period of 5 minutes or less.

9. The process of claim 8 wherein the organic solution is in contact with the leach solution for a period of 3 minutes or less.

5 10. The process of claim 8 wherein the organic solution is in contact with the leach solution for a period of 2 minutes or less.

10 11. The process of any one of claims 2 to 10, wherein the organic solution comprises a stabilizer against hydroxyoxime degradation.

12. The process of claim 11, wherein the stabilizer reduces oxidation and/or hydrolysis of the hydroxyoxime.

15 13. The process of claim 12, wherein the stabilizer is an anti-oxidant.

20 14. The process of any one of claims 1 to 13, wherein the solvent extraction step effects extraction of a large proportion of the nickel, cobalt, copper and zinc into an organic phase, to the extent that these elements are present, with a large proportion of the calcium, magnesium, manganese and chloride being rejected to the aqueous phase.

25 15. The process of any one of claims 1 to 14, wherein the leach solution contains impurity elements selected from one or more of calcium, magnesium, manganese and chloride, optionally together with copper and/or zinc.

30 16. The process of any one of claims 1 to 15, wherein the leach solution is a solution that has been subjected to a preliminary iron and/or aluminium precipitation step to precipitate out iron and/or aluminium to leave an aqueous leach solution containing the target elements and impurity elements other than iron and aluminium.



17. The process of any one of claims 1 to 16, wherein the carboxylic acid is 2-methyl, 2-ethyl heptanoic acid or a cationic exchange extractant having extraction characteristics similar to 2-methyl, 2-ethyl heptanoic acid.
18. The process of any one of claims 1 to 17, wherein the hydroxyoxime is a chelating  $\alpha$ -hydroxyoxime.
19. The process of any one of claims 1 to 18, wherein the kinetic accelerator increases the rate of extraction and/or stripping kinetics of nickel.
20. The process of any one of claims 1 to 19, wherein and the pH of the aqueous phase in the solvent extraction step is maintained in the range of from 5.0 to 6.5 to effect extraction of the cobalt and/or nickel into the organic phase.
21. The process of claim 20, wherein the pH of the aqueous phase in the solvent extraction step is maintained in the range of from 5.5 to 6.0.
22. The process of claim 21, wherein the organic phase from the solvent extraction step is subjected to scrubbing.
23. The process of any one of claims 1 to 22, wherein cobalt and nickel are extracted into the organic phase, and the organic phase is subjected to selective stripping to separate to a significant extent the cobalt from the nickel.
24. The process of claim 23, wherein the selective stripping comprises contacting the organic phase from the solvent extraction with an acidic aqueous solution to

yield (a) a loaded strip liquor containing cobalt, and (b) a selectively stripped organic solution containing nickel.

5 25. The process of claim 24, wherein the acidic aqueous solution used in the selective stripping has a pH in the range of 3.0 to 4.0.

10 26. The process of any one of claims 23 to 25, wherein the cobalt is recovered from the loaded strip liquor.

27. The process of claim 26, wherein the cobalt is recovered by cobalt precipitation.

15 28. The process of any one of claims 23 to 27, wherein the nickel is recovered from the stripped organic solution from the selective stripping step.

20 29. The process of claim 28, wherein the organic solution from the selective stripping step contains nickel and copper, and is subjected to stripping with an aqueous acid solution to separate the nickel into the aqueous phase with only a small amount of the copper, followed by ion exchange to remove the copper, and the nickel is recovered from an eluate of the ion exchange.

25 30. The process of claim 22, wherein the scrubbed organic solution is stripped to obtain (a) a loaded strip liquor containing nickel and cobalt, and copper and zinc to the extent that copper and zinc are present, and (b) a  
30 stripped organic solution.

31. The process of claim 30, wherein the loaded strip liquor is subjected to organophosphinic acid solvent extraction.

35 32. The process of claim 31, wherein the organophosphinic acid solvent extraction produces (a) a

loaded organic solution which contains cobalt (and zinc and copper, to the extent they are present), and (b) an aqueous raffinate containing nickel.

5 33. The process of claim 32, wherein the loaded organic solution from the organophosphinic acid extraction is scrubbed, the scrubbed organic solution containing cobalt (copper and zinc) is subjected to stripping with sulphuric acid at an appropriate pH, the loaded strip  
10 liquor containing cobalt (copper and zinc) is subjected to ion exchange to remove copper and zinc present, and cobalt recovered from the eluate.

15 34. The process of claim 33, wherein nickel is recovered from the aqueous raffinate from the organophosphinic acid extraction.

20 35. The process of any one of claims 1 to 34, wherein scrubbing is conducted on the organic phase after each solvent extraction.

36. A product recovered by the process according to any one of claims 1 to 35.